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the profit would therefore be £1 11*s.* 2*d.*, leaving a balance in favour of smelting the ore by the blast-hearth of 6*s.* 3*d.* per ton of ore, or an increased profit of nearly 17 per cent. If Mr. Sadler's estimate be adopted, the balance would be three times this sum.

"On the whole, I think it fair to conclude that the reverberatory furnace makes larger returns of lead; that where the produce of ore is inadequate to the supply of a reverberatory furnace, or where the cost or carriage of fuel and other materials is high, the blast-hearth is not without its advantages; that it is in vain to inquire, in the abstract, which is the more profitable furnace, as the decision of the question entirely depends on the circumstances of the locality."

April 24th, 1848.

REV. HUMPHREY LLOYD, D. D., President,
in the Chair.

The Rev. Charles Graves made a communication respecting Mathematical Expressions for Hypothetical and Disjunctive Propositions.

Adopting the principles and notation furnished by Mr. Boole in his "Application of Analysis to Logic," Mr. Graves suggests that it would be more in accordance with the ordinary use of language to express the hypothetical proposition,

If *X* be true, *Y* is true,

by the equation

$$x = vy, \tag{1}$$

than by that which Mr. Boole has employed, viz.

$$x(1-y) = 0. \tag{2}$$

In the former of these equations the symbol x selects all the cases in which the antecedent X is true, whilst y selects those in which the consequent Y is true; and v denotes an indeterminate symbol of election. The verbal enunciation, therefore, of equation (1) is, that *all the cases of the truth of X are included amongst cases of the truth of Y:* a statement which resembles the proposition,—If X be true, Y is true,—more nearly than the verbal interpretation of equation (2), which asserts that *there are no cases of the truth of X included amongst cases of the falsehood of Y.*

It is interesting to observe how readily the ordinary rules for hypotheticals flow as mathematical consequences from equation (1), regarded merely as an equation between commutative and distributive symbols.

1. If $y = 0$, $x = 0$.
2. If $x = 0$, it does not follow that $y = 0$.
3. If x be not $= 0$, y is not $= 0$.
4. If y be not $= 0$, it does not follow that x is not $= 0$.

These mathematical results being interpreted, give the following well-known rules:

1. If the consequent be false, the antecedent must be false.
2. The falsehood of the antecedent does not prove the falsehood of the consequent.
3. If the antecedent be true, the consequent must be true.
4. The truth of the consequent does not prove the truth of the antecedent.

The following example, treated by Mr. Boole in his book, p. 57, illustrates the use of the form here proposed for the equations of hypothetical propositions.

If X be true, either Y is true or Z is true.

But Y is not true.

Therefore, if X be true, Z is true.

The foregoing argument is succinctly expressed by means of the following equations:

$$x = v\,(y + z + yz)$$
$$y = 0$$
$$x = vz.$$

The immediate verbal interpretation of the first of which is, that *the cases in which X is true* (x) *are found by taking* ($=$) *the aggregate of all the cases in which Y and Z are separately and simultaneously true* ($y + z + yz$), *and selecting from this aggregate according to some law of election* (v), *the nature of which is not defined in the proposition.*

Mr. Graves added, that he had the satisfaction of learning that his suggestion, with respect to the mathematical expression of hypothetical propositions, had met with Mr. Boole's approval. In fact that gentleman had himself contemplated making the change here proposed, in pursuance of a like hint thrown out by Mr. Graves in the case of Categoricals.

Rev. Dr. Todd read the following extract from a letter addressed to Dr. Apjohn, from Robert R. Cornwall, Esq., of Killucan:

"In digging round a rock in one of my fields, for the purpose of having it blasted, four very old graves were found; the bodies had evidently no coffins, but were surrounded on three sides by common, rough, flat stones, set upright on the edge. The rock answered for the headstone. The graves were but three feet long, twenty-two inches wide, and little more than two feet from the bottom of the grave to the grass. The bones very much decayed and broken; the top of one skull, and the face of another, were all that I could get in any way sound."

The President read the following communication from Mr. Stewart Blacker, upon an extraordinary Rainbow observed by him on the 7th of March in the north of Ireland: